CLAIMS

1. A shutter mechanism for controlling reactants in a direct oxidation fuel cell system, having at least one fuel cell including a membrane electrode assembly, comprising:

    a moving component disposed within the fuel cell between a source of a reactant and the membrane electrode assembly and said moving component having features formed therein that correspond with features on a receiving element such that when said moving component is placed adjacent to said receiving element, the flow of said reactant is controlled.

2. The shutter mechanism as defined in claim 1 wherein said features on said moving component are protrusions, and said corresponding features on said element are openings, and said protrusions plug said openings when said moving component is placed adjacent to said receiving element.

3. The shutter mechanism as defined in claim 3 wherein said moving component is placed between a fuel source and an anode aspect of said fuel cell, and said receiving element is an anode current collector and when said moving component is placed adjacent to said anode current collector, fuel flow to said anode aspect is restricted.

4. A shutter mechanism for a direct oxidation fuel cell system, comprising:

    (A) a fuel source;

    (B) a direct oxidation fuel cell, including:

        (i) a protonically conductive membrane having catalyst coatings on each of its major surfaces, being an anode aspect and a cathode aspect;

        (ii) an anode current collector disposed generally at said anode aspect;

        (iii) a cathode current collector disposed generally at said cathode aspect;

(iv) a passive mass transport barrier disposed generally between said fuel source and said anode aspect and spaced from said anode aspect to define a vapor gap in said fuel cell, said passive mass transport barrier controlling a rate of fuel delivery to said catalyzed anode aspect of said fuel cell;

(v) a movable shutter plate disposed within said vapor gap between said passive mass transport barrier and said anode current collector such that said movable shutter plate is adjustable to substantially or partially prevent fuel flow through said anode current collector to the anode aspect of said fuel cell; and

(vi) a load coupled between said anode current collector and said cathode current collector for utilizing the electricity generated by the fuel cell.

5. The shutter mechanism as defined in claim 4 further comprising:

said movable plate having a plurality of protrusions disposed thereon that correspond with openings in said anode current collector, such that when said movable plate is adjusted to a closed position, said protrusions interconnect with the openings in the anode current collector to substantially seal said openings, and said movable plate also having apertures therein interspersed with said protrusions in such a manner that when said movable plate is in an open position, said apertures allow for flow of fuel therethrough; and

said movable plate is adjustable in a direction perpendicular to the plane in which the plate is disposed, such that when it is adjusted, the plate travels generally in a z-axis within said vapor gap, closer to or further away from said anode current collector, to control fuel flow while not consuming substantially additional volume within said fuel cell.

6. The shutter mechanism as defined in claim 5 further comprising:

said protrusions have angled sides; and

said openings in said anode current collector being correspondingly angled such that said protrusions interconnect securely within said angled openings of said current collector to substantially seal said openings against fuel flow.

7. The shutter mechanism as defined in claim 5 wherein said protrusions are substantially comprised of a compliant material that is compressed into said openings when said movable plate is adjusted to a closed position.

8. The shutter mechanism as defined in claim 5 further comprising a coating disposed on the sides of said protrusions in said movable plate which further secures sealing of said anode current collector against fuel flow therethrough.

9. A shutter mechanism for a direct oxidation fuel cell system, comprising:

(A) a fuel source;

(B) a direct oxidation fuel cell, including:

(i) a protonically conductive membrane having catalyst coatings on each of its major surfaces, being an anode aspect and a cathode aspect;

(ii) an anode current collector disposed generally at said anode aspect, said anode current collector having a plurality of openings therein allowing for a flow of substances into and out of said fuel cell;

(iii) a cathode current collector disposed generally at said cathode aspect;

(iv) a movable plate having openings that correspond with openings in said anode current collector and said movable plate being adjustable in a lateral direction that is generally parallel to the plane in which the plate is disposed, such that when the plate is adjusted, the openings in said plate are aligned

with the openings in said anode current collector providing apertures for fuel flow, and when said plate is adjusted in an opposite direction, said openings are not aligned such that fuel flow is controlled or substantially prevented from entering said fuel cell; and

(v) a load coupled between said anode current collector and said cathode current collector for utilizing the electricity generated by said fuel cell.

10. A shutter mechanism for a direct oxidation fuel cell system, comprising:

(A) a fuel source;

(B) a direct oxidation fuel cell, including:

(i) a protonically conductive membrane having catalyst coatings on each of its major surfaces, being an anode aspect and a cathode aspect;

(ii) an anode current collector disposed generally at said anode aspect;

(iii) a cathode current collector disposed generally at said cathode aspect;

(iv) a movable shutter plate disposed adjacent to said cathode current collector such that said movable shutter plate is adjustable to substantially or partially prevent oxygen flow through said cathode current collector to the cathode aspect of said fuel cell, and to substantially or partially prevent water vapor from being released from said fuel cell; and

(v) a load coupled across said anode current collector and said cathode current collector for utilizing the electricity generated by said fuel cell.

11. The shutter mechanism as defined in claim 10 further comprising:

said movable plate having a plurality of protrusions disposed thereon that correspond with openings in said cathode current collector, such that when said

movable plate is adjusted to a closed position, said protrusions interconnect with the openings in the cathode current collector to substantially seal said openings, and said movable plate also having apertures therein interspersed with said protrusions in such a manner that when said movable plate is in an open position, said apertures allow for flow of oxygen therethrough.

12. The shutter mechanism as defined in claim 11further comprising:

said protrusions have angled sides; and

said openings in said cathode current collector being correspondingly angled such that said protrusions interconnect securely within said angled openings of said current collector to substantially seal said openings against escape of water vapor.

13. The shutter mechanism as defined in claim 11 wherein said protrusions are substantially comprised of a compliant material that is compressed into said openings when said movable plate is adjusted to a closed position.

14. The shutter mechanism as defined in claim 11 further comprising a coating disposed on the sides of said protrusions in said movable plate which further secures sealing of said cathode current collector.

15. A shutter mechanism for a direct oxidation fuel cell system, comprising:

(A) a direct oxidation fuel cell, including:

(i) a protonically conductive membrane having catalyst coatings on each of its major surfaces, being an anode aspect and a cathode aspect;

(ii) an anode current collector disposed generally at said anode aspect;

(iii) a cathode current collector disposed generally at said cathode aspect, said cathode current collector having a plural-

ity of openings therein allowing for flow of substances into and out of said fuel cell;

(iv) a movable plate having openings that correspond with openings in said cathode current collector and said movable plate being adjustable in a lateral direction that is generally parallel to the plane in which the plate is disposed, such that when the plate is adjusted, the openings in said plate are aligned with the openings in said cathode current collector providing apertures for oxygen flow, and when said plate is adjusted in an opposite direction, said openings are not aligned such that oxygen flow is controlled, and water vapor is substantially prevented from exiting said fuel cell; and

(v) a load coupled between said anode current collector and said cathode current collector for utilizing the electricity generated by said fuel cell.

16. A method of transferring heat in a direct oxidation fuel cell system, including the steps of:

(A) providing a movable plate, said movable plate having a plurality of protrusions disposed thereon that correspond with openings in a current collector of an associated direct oxidation fuel cell;

(B) adjusting said movable plate to a closed position in which said protrusions interconnect with the openings in the current collector to substantially collect heat from said current collector; and

(C) transferring heat from said current collector to another portion of the fuel cell system, or dissipating heat out of said fuel cell system via said movable plate.

17. The method of transferring heat in a direct oxidation fuel cell system as defined in claim 16 including the further step of

adjusting said movable plate in a direction perpendicular to the plane in which the plate is disposed, such that when it is adjusted, the plate travels generally in a z-axis, and comes in contact with said current collector to collect heat.